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# SEEDING FOR RANGE IMPROVEMENT

SPECIES • ADAPTATIONS  
METHODS • MANAGEMENT

*Compiled by*

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## RANGE SEEDING

RANGE SEEDING has reached large proportions in recent years as a result of research by the College of Agriculture and extensive field tests carried on by the College and its Farm Advisors in many counties. In initiating a program of range improvements the experience gained from these tests should be determined and used as a guide to practices and plant species to be used.

It is the purpose of this booklet to aid in promoting sound practices that will lead to the permanent improvement of dry land forage resources. Both the advantages and limitations are therefore briefly stated.

**TIME OF SEEDING:** In practically all of California fall seeding is recommended so that germination and growth may have full advantage of the winter rains, but planting too early is hazardous. There may be an early rain, sufficient to germinate the seed, followed by a long dry period before the regular rainy season arrives. Seeding time of the most successful dry land grain growers is a good guide to range re-seeding. An exception to this rule is found in seeding in the ash of brush burns, as noted below. Here it is desirable to have the seed in the ash before it is compacted by rain.

In any event, an operation that is as dependent on weather as is dry land seeding should be planned well in advance and executed at the most advantageous time. One of the requisites of this is fore-seeing seed needs and having supplies on hand well before they are needed. The difference between success and failure may hinge upon the essential detail of timeliness.

**AMOUNTS OF SEED:** In dry land seeding, moisture is a great limiting factor. These areas will not usually support dense stands of deep-rooting perennials, and even the seeded annuals are likely to become dwarfed when the stand is too thick. Extensive tests have shown that from 7 to 12 pounds of total seed per acre are sufficient for most sites where the rainfall is adequate to justify any range seeding.

**KNOW WHAT YOU SOW:** Most range land is comparatively low in valuation and in per acre returns. Even a slight increase in the quantity and quality of the cover may bring about a marked increase in the annual return and value of the land. Certain fixed costs are essential to these results. The risk should not be exaggerated by planting seeds of poor or uncertain quality. Range weeds are always a problem of major proportions. Seeds with a high weed content only aggravate this condition. It is sound business to sow only seeds of high germination, known identity, free from weed seeds. Pure seed is a sound investment.

**METHODS OF SEEDING:** A Cultipacker-seeder is the most suitable machine for sowing and covering on a prepared seedbed. On most rough range lands it is practically impossible to secure uniform depth in drilling seed. Some range topography does not permit the use of a drill. Broadcasting is satisfactory if there is a firm seedbed. If the soil is corrugated by cultipacking, or by a shallow disking or springtoothing, rain will usually cover the seed satisfactorily. If the soil is smooth, seeding should be followed by a light harrowing or cultipacking. *A firm seedbed is essential.* Small seed planted in freshly-plowed, loose soil is wasted.



**SOWING ON SOD** is precarious business. Only a few species are adapted to this use and seed losses will then be heavy, but later volunteering may thicken the stand. When this practice is to be followed the resident cover should be mowed and raked, or closely grazed so that the seed can fall on exposed soil. The species that will give the best result in this kind of sowing are: bur clover, rose clover, subclover, birdsfoot trefoil, annual and perennial ryegrasses, burnet and filaree. Arable sod can be disked and then seeded and managed as described below with better results in plant stands.

**SOWING ON A PREPARED SEEDBED:** The best preparation for reseeding is to fallow the land for a year and keep it free from weeds. Fallow is as useful for a forage crop as it is for small grains. It serves to reduce the competition of resident growth and to accumulate some free nitrogen which helps to give the seeded plants a good start and to promote stooling. If the fallow is soft and loose at seeding time a cultipacker should be used to firm it. A firm seedbed is essential to success.

The stubble of grain, vetch and grain, or sudan usually leaves a condition favorable for pasture seeding. A light disking, cutting the soil only to a depth of one and a half to two inches, but turning it thoroughly, will usually suffice. Seed can be broadcast directly on the disked soil without covering. Better results will usually follow if the seed is firmed into the soil with a cultipacker.

**SEEDING IN BRUSH BURNS:** Seeding in the ash of heavy brush burns has been found to be a promising method of revegetating such areas with the best adaptable species. There are several sound reasons for this:

(1) The competition of resident plant cover is not severe in such areas and this enables the seeded plants to get the full benefit of both sunlight and moisture; (2) Brush ash is rather rich in available fertilizer elements, especially nitrogen; (3) The ash of a burn provides a good covering for the seed. To get full advantage of this, seeding should be done before the ash has been compacted by the fall rains, or by prolonged action of wind, dew and frost.

Areas where brush has been removed by mechanical methods also usually furnish moderately good seedbed conditions and the same freedom from competition as noted above.

**MANAGEMENT:** Experience has showed that the three most restrictive factors in range revegetation through seeding are: (1) First-year competition of resident plants; (2) Moisture limitations during the critical dry summer; (3) Prolonged or untimely overgrazing.

The first of these must be carefully controlled, especially in the first year after seeding. Where the topography permits, a mower is the best means of reducing resident grasses and weeds. Mowing should be done at the most favorable time to preserve moisture and prevent seed production. Several mowings may be essential to the best results.

Where it is too rough or too steep for mowing, seeded areas should be rather closely grazed as soon as the resident growth reaches pasturable proportions, and while this growth

is green and most nutritious and before its seeds are formed. This will serve to admit sunlight to the slower starting seeded plants and to reduce the seed yield of resident competition. Then remove stock while there is sufficient moisture in the soil to promote the continued growth of seeded plants.

NOTE: The above grazing practices do not apply to seeding in brush burns. When grazed too early, plants sown in ash are likely to be pulled out and the young roots thus destroyed. *On burns, first-year grazing should be delayed until the sown plants have set seed.*

ROTATION GRAZING: After the first year, a system of rotation grazing should be adopted, such as described in Extension Circular No. 129 (see references on back page). Seeding cannot be effective or permanent in improving range forage unless grazing practices are so applied that the plants have an opportunity to nourish themselves by reaching an advanced stage of maturity at least once in each cycle of 3 to 5 years. Every range seeding project should be accompanied by a program of adjusted grazing.

SPECIES AND ADAPTATIONS: In the course of its range improvement program the College of Agriculture has tested several hundred species of plants from all parts of the world. Many have been discarded as not adapted to conditions prevailing in California. All of those that remain on their active list are charted on the inside of this booklet.

Some species, such as the grama grasses, are very drought tolerant, but require summer rains and are therefore not adaptable to California conditions. Some others, such as the love grasses, require spring planting in warm soil.

Some of the plants that are recommended have rather narrow limits of adaptation, others succeed over a wide soil and climatic range. The primary points in adaptations are given on the chart of species. Further information can be had from the references cited.

Standard mixtures might be made up of those species that are recommended in at least five of the six climatic zones. Alfalfa, Mountain Brome and Sweet Clover are found in all six. Annual Ryegrass, Subclover, Harding Grass and Burnet occur in all but Zone 6, and Tall Fescue in all but Zone 5. Harlan Brome, the Stipas, Smilo and Rose Clover could be added over most of the zones. All zones have special problems and no fixed formula would fit all of them.

ZONE MAP: The Zone Map presented in this folder is an effort to coordinate elevation, rainfall and plant zones. Zone 7 is not considered since rainfall there is too low for any seeding operations. In Zone 5A, also, rainfall is too low for any dry land plantings except possibly with Stipas, Bur, Rose Clover and Subclovers, Filaree, and Annual Ryegrass.

## REFERENCES

For additional details regarding range seeding and management, write or contact Pasture Department, C. M. Volkman & Company, 55 Union Street, San Francisco 11, California. Local County Farm Advisors may also be excellent sources of information, since they are constantly in touch with local conditions. Further information can be secured from the College of Agriculture, Extension Circular No. 129, entitled "Range Improvement in California," and from the same source, Circular No. 371 entitled "Improving California Brush Ranges."







GRASSES AND HERBS

COMMON NAME	BOTANICAL NAME	ADAPTATION										SEEDING RATE—POUNDS PER ACRE		GENERAL INFORMATION	
		Zone 1 Zone 2 Zone 3 Zone 4 Zone 5 Zone 6						Alone	In Mixtures						
Bromegrass	Bromus stamineus	X	X	X	X	X	X	X	X	4 to 12	2 to 6	Medium tall, erect bunchgrasses, short-lived, but has the ability to mature seed near the ground and volunteer.			
Mountain (Calif.) Bromegrass	Bromus carinatus	X	X	X	X	X	X	X	X	5 to 15	3 to 8	Tall, erect bunchgrasses, moderately leafy. Resident throughout the state as a perennial, or as an annual where rainfall is low. Varies botanically.	3 to 8	Tall, erect bunchgrasses. Best on fertile soils and in coastal ranges. A perennial form of the famous rescue grass of the south.	
Prairie No. 25 Bromegrass	Bromus cartharticus	X	X	X						4 to 12	2 to 6	Medium tall, leafy bunchgrasses. Best on fertile soils and in coastal ranges.	2 to 6	A perennial form of the famous rescue grass of the south.	
Bromegrass Smooth	Bromus inermis								X	5 to 15	3 to 8	Erect, creeping, tall, leafy. Used in mountain meadows and other moist sites at high elevations.			
Burnet	Sanguisorba minor	X	X	X	X					5 to 15	2 to 8	Medium tall, leafy, herb of the rose family. Pyramidal growth, tap-rooted. Persistent and green all summer. Most useful on hard sites. Not recommended with alfalfa because it competes for subsoil moisture.	2 to 8	Medium tall native bunchgrass with stems growing at an angle, fine basal leafage, green all summer. Long lived and very palatable. New strain being developed for high germination. Plant develops cleistogenes to resist drought.	
+California Oatgrass	Danthonia californica	X	X							5 to 10	2 to 6	Medium tall native bunchgrass with stems growing at an angle, fine basal leafage, green all summer. Long lived and very palatable. New strain being developed for high germination. Plant develops cleistogenes to resist drought.			
Fescue, Tall (Alta)	Festuca arundinacea	X	X	X	X					4 to 8	1 to 4	Tall erect bunchgrasses, abundant basal leafage, long-growing season. Relished by all stock. Likely to succeed in moderate stands near the coast and where rainfall is 20 inches or more.	1 to 4	Developed in California. Has strong seedling vigor, more uniform, and more resistant to alkali and high temperatures than Alta Rescue.	
Goar, Tall Fescue	Festuca arundinacea	X	X	X	X					4 to 8	1 to 4	Developed in California. Has strong seedling vigor, more uniform, and more resistant to alkali and high temperatures than Alta Rescue.			
Filariae	Erodium spp	X	X	X	X	X				2 to 4	1 to 2	There are three common species, redstem, whitestem, and broadleaf. An annual herb usually resident among annual grasses and legumes. Can be sown on range sod and will work its way into the soil when wet. Good as green or dry feed.			
Hardinggrass	Phalaris tuberosa var stenoptera	X	X	X	X	X				2 to 6	1 to 3	Tall, leafy, with short rhizomes. Winter-growing in its best range. Does not survive severe winters. Forms bulbs to resist drought. One of the best and most durable dry land grasses. Difficult to start in severe competition. Especially useful for seeding in the ash of brush burns.	1 to 3	Tall, erect bunchgrasses, leafy at base and on stems. Good palatability.	
Orchardgrass	Dactylis glomerata	X	X	X	X					3 to 6	1 to 3	Tall, erect bunchgrasses, leafy at base and on stems. Good palatability.	1 to 3	About as drought-hardy as tall fescue. Does well in shade.	
Rhodesgrass	Chloris gayana		X							2 to 6	1 to 3	Erect, leafy with long runners that root at the joints. Very alkali-tolerant. Needs warm soil to start and is used on dry land chiefly in southern California where winter temperatures enable it to start in the rainy season. Will not survive temperatures below 18° F.			
Common, Annual, Domestic, Italian Ryegrass	Lolium multiflorum	X	X	X	X	X				4 to 8	1 to 4	Medium tall, annual on dry land, stems leafy. One of the most popular for dry land. Green later in spring than most annuals. Will not survive unless grazed so as to allow some seed to mature for volunteering. Good winter grower in southern part of range.			
Ryegrass Perennial Australian, English	Lolium perenne	X	X	X	X	X				4 to 8	1 to 4	Less tall than annual, leafage mostly basal. Likely to survive as a perennial in all zones but 6. Especially useful for sheep.			
Smilo	Oryzopsis miliacea	X	X	X	X	X				2 to 4	½ to 2	Tall leafy bunchgrasses with extensive root system. Same climatic tolerances as Harding but better adapted to lighter soil types. Successful stands almost invariably obtained when planted in the ash of a brush burn. Should not be persistently overgrazed.			
+Soft Chess	Bromus mollis	X	X	X	X	X				4 to 8	1 to 4	A palatable annual grass of major importance. Seed not available at present.			
+Stipa Nodding	Stipa cernua	X	X	X	X	X				2 to 6	1 to 4	Medium tall bunchgrasses, leafage mostly basal and green until late summer. Harsh, but grazed after annuals dry. Selected by the California Experiment Station for leafiness and uniformity.			
Stipa Purple	Stipa pulchra	X	X	X	X	X				2 to 6	1 to 4	Similar to cernua, but with wider leaves. Same history of selection. When sown together pulchra and cernua usually develop a moderate stand of field hybrids of strong vigor and late green growth.			
Sudan Grass	Sorghum vulgare var sudanense	X	X	X	X	X				4 to 10	Plant alone	Very tall, erect, summer growing annual, a selection of common. A heavy producer of summer green feed when spring planted in damp warm soil. Generally drilled down to moisture. Graze when 12 to 16 inches tall and graze heavily enough to prevent seed formation. Too tall to be used in a mixture. No. 23 an improved strain of Common Sudan.			
Sudan Grass	Sorghum sp.	X	X	X	X	X				4 to 10	Plant alone	A Texas cross of Sudan and Sweet Sorghum. Stems are sweet and relished by livestock. Range, tolerance and use about the same as Common.			
Tall Meadow Oatgrass	Arrhenatherum elatius	X	X							5 to 10	3 to 6	Tall, erect bunchgrasses with somewhat sparse leafage. Volunteers freely in its range in central and northern coastal counties and high elevations.			
Tall Oatgrass	Arrhenatherum elatius	X	X							5 to 10	3 to 6	An Oregon selection that does not shatter its seed. Shorter and with more basal leafage than common strain. Test plantings indicate higher feed production and possibly wider range than common.			
Veldtgrass	Ehrharta calycina		X	X	X	X				2 to 4	¾ to 2	Tall, leafy bunchgrasses, green all summer. Seed low in germination. Volunteers well. Proving useful on light soils in southern California.			
Wild Oats	Avena fatua	X	X	X	X	X				5 to 10		A tall, winter-growing annual in its range. Valuable green feed, poor as a dry feed. Recommended only where it can be moved green and fed from bunch or windrow.			
Wheatgrass	Agropyron desertorum (formerly Agropyron cristatum)									4 to 10	1 to 4	Medium tall, deep-rooted bunchgrasses, leafy stems. Good palatability. Winter hardy and drought-resistant. The most prevalent species for reseeding at high elevations where it is often sown with Ladak alfalfa, for hay and pasture.			
Wheatgrass Intermediate	Agropyron intermedium									4 to 10	1 to 4	Spreads by underground stems and produces an open sod. Not so drought tolerant as Crested. Strong seedling vigor and well able to compete with resident weeds.			
Wheatgrass Tall	Agropyron elongatum									5 to 10	1 to 4	Tall vigorous bunchgrasses. Very alkali tolerant. About same palatability as Crested Wheatgrasses.			
LEGUMES*															
Alfalfa Common No. 49	Medicago sativa	X	X	X	X	X	X	X	X	4 to 8	1 to 4	Medium tall, erect, tap-rooted. Best producer of summer green feed. Very drought hardy if planted in a sparse stand on dry land. South half of state fall seeding advised. North half, seed in spring and sow grasses the following fall. California is improved common resistant to Bacterial Wilt and leaf spot. Alfalfa Common No. 49 is resistant to Bacterial Wilt disease often found in the southern part of the state.			
Alfalfa Ladak	Medicago sativa								X	4 to 8	1 to 4	Same growth habit as common. More winter-hardy and equally drought-tolerant. Useful at the highest elevations in all zones.	1 to 2	Prostrate with long runners, leafy, deep-rooted. Highly palatable except when in bloom. Alkali-tolerant. Green all summer. Survival possible wherever rainfall is 20 inches or more.	
Birdfoot Trefoil (Narrowleaf Trefoil)	Lotus tenuis	X	X	X	X	X			X	2 to 4	1 to 2	Prostrate with long runners, leafy, deep-rooted. Highly palatable except when in bloom. Alkali-tolerant. Green all summer. Survival possible wherever rainfall is 20 inches or more.			
Birdfoot Trefoil (Erect)	Lotus corniculatus var vulgaris	X	X	X	X	X			X	2 to 4	1 to 2	Stronger stemmed than tenuifolius, semi-erect. Leaflets over half as wide as long. Best growth in neutral or acid soils. Deeper rooted and possibly more drought-hardy than tenuifolius.			
Bur Clover	Medicago hispida	X	X	X	X	X			X	2 to 10	1 to 4	Semi-prostrate winter annual. Best on heavy soils. Dry burs valuable as summer feed. Crowded out by severe competition.			
Crimson Clover Reseeding	Trifolium incarnatum	X	X	X	X	X			X	2 to 8	1 to 4	Winter annual, semi-tall. Reseeds itself very well. Easily distinguishable by its bright crimson blossom.			
Rose Clover	Trifolium hirtum	X	X	X	X	X			X	2 to 6	1 to 3	Annual, medium tall leafy, branching and hairy. More winter hardy than Bur Clover. Green later in spring than Bur or Subclover. Seeds and volunteers freely. Well adapted to all areas of California except high mountains and poorly drained soils.			
Subclover	Trifolium subterraneum	X								2 to 8	1 to 4	Same general growth habit as above, but two weeks later in spring. Will do in higher rainfall areas of all zones. Subclovers sometimes require phosphate or sulfur for best growth.			
White Sweet Clover	Melilotus alba	X	X	X	X	X			X	2 to 6	1 to 4	Biennial, tall, branching, leafy, tap-rooted. Extensive root development enables the sweet clovers to withstand drought. They are useful in light soils and alkaline soils. Sow in spring where winters are cold.			
Yellow Sweet Clover Madrid	Melilotus officinalis	X	X	X	X	X			X	2 to 6	1 to 4	Biennial. A selection of yellow sweet clover that is more robust, leafier, and more drought-resistant.			

\*All items are perennial unless otherwise noted.  
†Items not yet in commercial production or available only in limited amounts.



